International Symposium on Genetic Biocontrol of Invasive Fish
Current Status and Progress

The International Symposium on Genetic Biocontrol of Invasive Fish will be held at the Doubletree Hotel, Minneapolis, Minnesota, USA, June 21-24, 2010. The goal of the symposium is to explore the potential, development, and risk assessment of genetic biocontrol of established invasive finfish species. This symposium will assemble experts from a variety of relevant fields and professionals from the aquatic invasive species management community and bring them together in an interactive format designed to promote collaboration. The first three days of the symposium will focus on the technical aspects of the technology, the risk assessment of the technology, and the economic and regulatory contexts of the technology. The fourth day of the symposium will bring together leaders who will write three synthesis papers arising from discussions during the symposium. These papers will share the foci of the first three days of the symposium. We have invited 34 prestigious speakers from around the world. The complete list of speakers can be found in the agenda but includes Robert Devlin, Keith Hayes, Ron Thresher, and, as keynote dinner speaker, Dan Simberloff.

Additional information can be found in the attached agenda as well as at the symposium's website (http://www.seagrant.umn.edu/ais/biocontrol).

Currently we have raised funding and in-kind support from US FWS CAP Transfer Program, the Bureau of Reclamation, Australia's Murray-Darling Basin Commission, USDA's Biotech Risk Assessment Grant, the Great Lakes Protection Fund, Minnesota Sea Grant, and Dartmouth College. We are still hoping to raise approximately $20,000 of funding and would be grateful for any support the Mississippi River Basin Panel can offer.

Related to the symposium, we will be conducting a series of focus groups around the Great Lakes in order to provide the first in-depth descriptions of how different stakeholders in the Great Lakes community view the use of genetic biocontrol of invasive species. The focus groups will be conducted in advance of the symposium (November 2009 - January 2010) to allow the findings to frame discussions at the symposium in order to address the issues of greatest concern to interested stakeholders. More details about these focus groups can be found in the attached description of the project.

Any questions regarding the symposium and the focus groups, especially from those interested in participating can be directed to me, Leah Sharpe. My contact information is:

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Appendix 1: Description of Symposium and Current Agenda

International Symposium on Genetic Biocontrol of Invasive Fish

Doubletree Hotel, Minneapolis, Minnesota, USA, June 21-24, 2010

Purpose: This international symposium will address the potential, development and risk assessment of genetic biocontrol of established invasive finfish species. The symposium will also consider the potential for control of invasive mussel species. Genetic biocontrol refers to release of genetically manipulated organisms designed to disrupt the survival or reproduction of a targeted invasive species.[1] Genetic biocontrol strategies have the capability to be more effective and targeted than current control methods, all of which have major flaws.[2] Turning genetic biocontrol methods into practical tools, however, requires identifying and successfully addressing obstacles and concerns.

The symposium will assemble scientists from fish genetics and biotechnology to risk assessment science and ecology, and professionals working in various facets of managing aquatic invasive species. The first day will address the status of genetic biocontrol technologies, including chromosome-based, gene-based and other targeted methods. Day one will also address combining genetic biocontrol methods with other control methods (e.g. pheromone attractants, mechanical control) to improve control efficiencies; and involvement of stakeholders in deliberation on this emerging technology. The second day will address scientific risk assessment of these technologies. This will start with an overview of environmental risk assessment and then focus on early steps in risk assessment, including status of the science, research needs and a methodology for stakeholder deliberation. The third day will address the regulatory and economic contexts. Also, participants will meet in small groups to outline research agendas for technology development and for risk assessment. Finally, a subset of participants will meet to integrate break-out group ideas into more complete outlines for peer-reviewed synthesis papers.

Symposium Objectives: This symposium will bring together fisheries managers, industry representatives, and government regulators with experts in all facets of genetic biocontrol, in order to:

1. review the status of genetic biocontrol technologies for aquatic invasive species (with a focus on finfish) and develop a research agenda for future development;
2. consider current methodologies for environmental risk assessment, and develop a roadmap for risk assessment of genetic biocontrol of aquatic invasive species;
3. discuss stakeholder involvement in development and assessment of this technology;
4. examine the regulatory context for genetic biocontrol of invasive fishes and mussels; and
5. consider economics of impacts of aquatic invasive species and of genetic biocontrol technologies.

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[1] Kapuscinski, A.R. and T. J. Patronski. 2005. *Genetic Methods for Biological Control of Non-native Fish in the Gila River Basin*. Contract report to the US Fish and Wildlife Service. MN Sea Grant Publication F 20. 100 p. Available at www.seagrant.umn.edu/publications/F20.

[2] Thresher, R.E. 2008. Autocidal technology for the control of invasive fish. *Fisheries* 33(3):114-121.

Symposium Results and Accomplishments: We will publish a peer-reviewed volume as a special issue of the journal *Biological Invasions*. This volume will include papers from individual presentations and multi-authored synthesis papers coming out of interactive sessions. We anticipate three synthesis papers:

- Genetic biocontrol technologies: research and development agenda to achieve aquatic conservation goals;
- Roadmap for environmental risk assessment and management of genetic biocontrol applications: synthesis of existing knowledge and prioritization of needs; and
- Regulatory and economic context affecting applications of genetic biocontrol technologies: synthesis of issues and needs.

Participants will also outline next steps for future collaborations. The intent is to encourage more comprehensive and efficient, longer term, or larger scale projects than any single entity can now fund. Synthesis papers will provide decision support for future uses of genetic biocontrol.

Steering Committee

The symposium steering committee has representation from academic, government, and private sectors (table 1).

Table 1. Steering committee members – accepted and invited

Name	**Position and Organizational Affiliation**
Anne Kapuscinski Chair	Sherman Fairchild Distinguished Professor of Sustainability Science, Dartmouth College & former Sea Grant Extension Specialist, University of Minnesota
Dan Ashe	Science Advisor to the Director, U.S. Fish and Wildlife Service
Jim Barrett	Manager of the Native Fish Strategy, Murray Darling Basin Commission
Robert Clarkson	Fishery Biologist, U.S. Bureau of Reclamation
Doug Duncan	Fish Biologist, U.S. Fish and Wildlife Service, Region 2 (Southwest Region)
Jeff Gunderson	Associate Director & Fisheries and Aquaculture Extension Educator, Minnesota Sea Grant College Program
Mike Hoff	Regional Aquatic Nuisance Species Coordinator, U.S. Fish and Wildlife Service, Region 3 (Great Lakes-Big Rivers Region) & Representative from Mississippi River Basin Panel on Aquatic Nuisance Species
K. Bruce Jones	Chief Scientist for Biology, U.S. Geological Survey
Glen Knowles	Fish and Wildlife Biologist, U.S. Fish and Wildlife Service, Region 2 (Southwest Region)
Weiming Li	Professor, Department of Fisheries and Wildlife and Department of Physiology, Michigan State University
Marshall Meyers	Executive Vice President and General Counsel of Pet Industry Joint Advisory Council
Leah Sharpe Symposium Coordinator	PhD candidate, Conservation Biology Graduate Program, University of Minnesota & National Science Foundation IGERT trainee in risk analysis of introduced species and genotypes

Format

This symposium will be highly interactive in order to maximize scientific exchange, build a shared understanding of the issues, and stimulate new collaborations. Sessions over four days alternate plenary presentations with smaller break out groups (see draft agenda below). In addition to invited speakers, we will also widely advertise the symposium to get broad attendance aiming for 100 people.

International Symposium on Genetic Biocontrol of Invasive Fish – DRAFT Agenda

Day 1 - Focus: development of genetic biocontrol technologies

Time	Session	Speaker(s)
8:00	Welcome, Overview of the Symposium	Anne Kapuscinski, U of MN
8:15	History of the Issue	Paul Barrett, US FWS Jim Barrett, Murray Darling Basin Commission
8:45	Chromosome-based: Sterilization	Tilman Benfey, U. of New Brunswick
9:15	Chromosome-based: Trojan chromosome	John Teem, FL Dept of Ag-Aquaculture
9:45	*Break*	
10:15	Gene-based: Deleterious gene spread	Ron Thresher, CSIRO Australia
10:40		Peter Grewe, CSIRO Australia
11:05	Gene-based: Techniques from insect pest control	Fred Gould, North Carolina State University
11:35	Other gene target methods	Weiming Li, Mich State U.
12:05	*Lunch*	
1:25	Process Description	Facilitators
1:40	Integrated pest management of invasive fish and	Peter Sorensen, U of MN
1:55	mussels	Nick Bax, CSIRO Australia
2:10		Daniel Molloy, New York State Museum*
2:30	Public Participation in GMO Development	TBD
3:00	*Break*	
3:30	Break-out groups: key points for technology research agenda	All participants
5:00	*End of Day 1*	

Day 2 – Focus: environmental risk assessment (ERA) of genetic biocontrol applications

Time	Session	Speaker(s)
8:00	Recap of Day 1, Set up for Day 2	Brian Stenquist
	The Basins and their Invasives:	
8:30	Colorado River	Paul Marsh, Arizona State University
8:50	Laurentian Great Lakes	Jeff Gunderson, MN Sea Grant
9:20	Mississippi River Basin	Mike Hoff, US FWS
9:40	Murray-Darling Basin	Jim Barrett, MDBC
10:00	*Break*	
10:30	Risk Assessment Methodology - major steps	Keith Hayes, CSIRO, Australia
11:30	*Lunch*	
1:00	Early steps in ERA for genetic biocontrol: hazards/harms & assessment endpoints	Anne Kapuscinski, U of MN
1:30	Research methods for assessment endpoints	Bob Devlin, DFO Canada
2: 00	Problem formulation and options assessment: an approach for deliberation	Kristen Nelson, U of MN
2:30	*Break*	
3:00	Break-out groups divided by Basin x Invasive x Technology: key points for ERA research agenda	All participants
5:00	*End of Day 2*	

Day 3 – Focus: regulatory and economic contexts affecting technology development & ERA

Time	Session	Speaker(s)
8:00	Recap of Day 2, Set up for Day 3	Brian Stenquist
8:30	Regulation – Framework & Questions	Jennifer Kuzma, U of M
8:45	National Level – USA	TBD, US FWS L. Rudenko, FDA-CVM* R. Stankiewicz-Gabel, USDA-BRS, Animals Branch
9:30	National Level - Australia	Wayne Fulton, IACRC
9:55	International Level – Cross-Border Concerns	Manoela Miranda, Cartegena Protocol Biosafety Unit
10:15	Tribal Entities	TBD
10:40	*Break*	
11:10	State Level: Minnesota	Luke Skinner, MN DNR*
11:30	Arizona	Larry Riley, AZ Game & Fish Dept
11:50	Another illustrative state? (NM, CA, other)	TBD
12:10	*Lunch*	
1:30	Economics: evaluating market & non-market costs of invasive fish	Frances Homans, U of M Brian Leung, McGill University
2:10	Economics: costs of genetic biocontrol	David Finnoff, Univ. of Wyoming
2:30	Small break-out groups draft outlines for 2 research agenda papers: 1 on technology development and 1 on risk assessment	Each group contains a lead co-author
3:30	*Break*	
3:50	Break-out groups continue drafting outlines	
5:00	Wrap-up of Symposium – Plenary Discussion	
5:30	*End of Day 3*	

Day 4

Time	Session	Participants
8:30 – 12 noon	Working groups on research agenda papers – integrate draft outlines from break-out groups into one expanded outline & agree on writing tasks and deadlines	Lead co-authors of papers

Keynote Dinner Speaker (date TBD) – Daniel Simberloff, University of Tennessee

* - Not yet confirmed as a speaker.

Appendix 2: Description of Focus Group Project

Focus Group Exploratory Studies

Focus groups are a valuable technique to explore people's feelings and opinions about a topic. These discussions are especially valuable for gaining understanding of how affected populations view issues for which little is known. Bringing a new technology like genetic biocontrol of invasive species into practical application will require a good understanding of people's knowledge base, values, attitudes, and concerns. Focus groups can begin this process by providing the first in-depth descriptions of how different stakeholders in the Great Lakes community see the use of this technology. The focus groups will be conducted in advance of the symposium (September 2009 to March 2010) to allow the findings to frame discussions at the international symposium in order to address the issues of greatest concern to the range of interested stakeholders.

In focus groups the goal is to design a comfortable environment in which participants feel able to share their opinions, ideas, and concerns without fear of retribution or disapproval. Focus groups are meant to pull together people with key characteristics in common so that they can participate in a 6 focused discussion on the topic of concern. The goal is not to reach a consensus, but rather to gain an understanding of participants' feelings about the topic being explored. These focus groups will bring together non-governmental organizations, state agencies, resource users, federal agencies, tribal governments and organizations, and international groups. It is important to hear from these groups because they will be the groups involved in developing and regulating any potential future use of this technology, as well as the groups who may be affected by the intended and unexpected consequences of the technology's use.

By conducting a focus group relatively early in the process of developing genetic biocontrol methods, we are able to understand how the participants currently view the idea of genetic biocontrol approaches: what they like about them, what they dislike, what language they use when discussing them, what would stop them from supporting this technology, and what would get them to use it. Specifically, these focus groups will be designed to:

• Gather information such as participants' most feared consequences, most desired outcomes, and whether some technological approaches would receive more social support than others;
• Help us determine what issues need to be discussed in the symposium's break out groups; and
• Help identify key points to be explored in the synthesis papers.

We will compile results of the focus groups and use them to refine the issues addressed by symposium speakers and deliberated during symposium break out group sessions. This will involve working closely with symposium facilitators and the symposium's steering committee. For example, if, in the focus groups, we found that a major concern was the potential for gene flow from the invasive fish bearing a 'biocontrol' transgene to closely related native fish, we would make sure that some of the break out groups on day 1 (see agenda) spent a portion of their time discussing this possibility. We would also make sure that this concern was considered by the authors of the environmental risk assessment synthesis paper.

In these focus groups, we are hoping to capture the full range of opinions held by participants on the topic of genetic biocontrol as well as discovering what underlying factors influence these opinions. This information will be invaluable in guiding future steps in the environmental risk assessment process for genetically modified organisms used as biocontrol. Further, focus groups have often been used in policy development and the results from these focus groups may provide valuable information to those agencies involved in developing regulations for this ground-breaking technology, if social support emerges for using it to control aquatic invasive species.

These focus groups will be conducted at five locations around the Great Lakes (Buffalo, NY, Cleveland, OH, Chicago, IL, Ann Arbor, MI, and Ashland, WI). These locations were selected so that we could invite participants involved with aquatic invasive species issues in all of the Great Lakes. We are also keeping open the possibility of conducting one online focus group so that key stakeholders unable to travel to any of those locations are still able to participate. As we confirm exactly who will be participating in each city, we will keep open the option to split each city's focus group up into multiple groups if the number of participants warrants it, as well as if we have concerns that varying levels of expertise on the issue or power in the field might interfere with other participants' comfort levels and therefore the honesty of their responses. Groups will be segregated so that each group contains participants of similar levels of expertise and/or power. Each focus group will be made up of six to twelve participants. Leah Sharpe will be the moderator of all the focus groups and will be assisted by someone from Sea Grant in each location.